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Description of an Improved Altazimuth Stand for Reflecting Telescopes, with a new Form of Binocular Eyepiece. By W. H. Thornthwaite.

Having been requested by Mr. H. Alers Hankey, of Queen Ann's Mansions, to provide some form of Binocular eyepiece especially applicable to telescopes of large aperture, such as the 12½-inch Equatoreal, with silvered glass mirror, which my firm were constructing for him. several experimental eyepieces of various forms were tried, and also a considerable amount of time and thought devoted to the subject of Binocular vision in connection with the telescope. I hope a short account of these experiments and their ultimate results may prove of interest to the Fellows.

There are two important advantages to be obtained by Binocular vision, the first being, as the name implies, the employment of both eyes, instead of confining observation to either the right or left eye; the second advantage consists in the apparent stereoscopic effect produced when both eyes are employed. In respect to the first-mentioned advantage, it will be admitted that the constant use of one eye must, after a time, be injurious both to that employed and also to its fellow. To take an extreme case, it is found that a single spectacle lens considerably injures the sight; the eye which is *not* assisted by the glass becoming after a time of a different focus to the other. But when both eyes are brought into action no such unpleasant results accrue; and as the observer discontinues his telescopic work, he finds his eyes are not nearly so fatigued by long-continued gazing as they would have been if only one eye had been used.

Secondly, it is impossible that any *real* stereoscopic effect can be noticed in viewing objects so distant, but it may be asserted that a considerable *apparent* effect is produced by Binocular vision. The rotundity of the Sun and Moon, and the mountainous surface of the latter, stand out in bold relief; *Jupiter* and *Saturn* appear *surrounded* by their Satellites, and not, as in an ordinary eyepiece, as a flat picture.

Having made these few general remarks on Binocular vision, I beg to append my own experience, and a short description of the eyepiece now exhibited.

The first eyepiece tried was an ordinary Binocular microscope, with an extra large "Wenham" prism. Except on the Moon, this form was found to be very trying to the eyes, on account of the strain put on them in order to make the two dull fields of the eyepieces coincide: using this form for a few minutes occasioned considerable giddiness. No such visual strain is experienced with a Binocular microscope in its ordinary employment, as the fields are much brighter, and therefore more easily made to coincide. Several other plans of dividing the cone of rays were tried without much success, the great difficulty being that the division must occur so close to the eyepieces, that their

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fields, with even moderately low powers, were only partially illuminated.

The Binocular now exhibited has neither of the preceding defects, the fields of low-power eyepieces being entirely illuminated, and it can be used for any length of time without tiring the eyes. Its principal disadvantage is the loss of light occasioned by several reflexions, but as with even moderately large telescopes, the light of the Moon and of some of the planets is excessive, especially to sensitive eyes, this defect must sometimes be an advantage. I may here remark, that I am now constructing a Binocular on a somewhat similar plan, but substituting prisms for silvered flats, and in which therefore the loss of light will be very small.

The principle of this instrument is very simple, and is as follows:—The rays of light from an object-glass or speculum fall on a silvered glass, placed at an angle of 45°, from this they are reflected at an angle of 90° to another silvered glass, parallel to the first, and thence to one eyepiece. But the first reflecting surface is an exceedingly thin coating of silver on a glass with parallel sides; a portion of the light is therefore transmitted through the transparent silver film, and then by two more silvered glasses it is reflected to the other eyepiece. The object of silver film is to avoid the secondary image which would be reflected from the inner side of the glass. The eyepieces are therefore side by side, and have their optical axes parallel; direct vision with each eye is thus obtained. The eyepieces have each an independent focussing slide, and they can be separated to accommodate different observers whose eyes may be various distances apart; this separation is affected by the milled head, the screw on one side of which is right-handed, and on the other left-handed; on revolving the milled head, therefore, the eyepieces are separated or brought nearer together. If solar or first surface prisms were used for the several reflexions, the instrument would form a Binocular for observations of the Sun.

The $8\frac{1}{2}$-inch Altazimuth on which the eyepiece is now shown, in order that the Fellows may roughly test its binocular performance, has been constructed with several important improvements. I will merely call attention to them in order that the Fellows may practically test their utility.

The open tube now adopted is so made that it shows that *any* closed tube may be similarly altered. The altitude clamp is of a novel kind, and is brought for convenience close to the eyepiece. Lastly, the screw motion in azimuth is continuous throughout the entire circle, or may be at pleasure thrown out of gear.

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